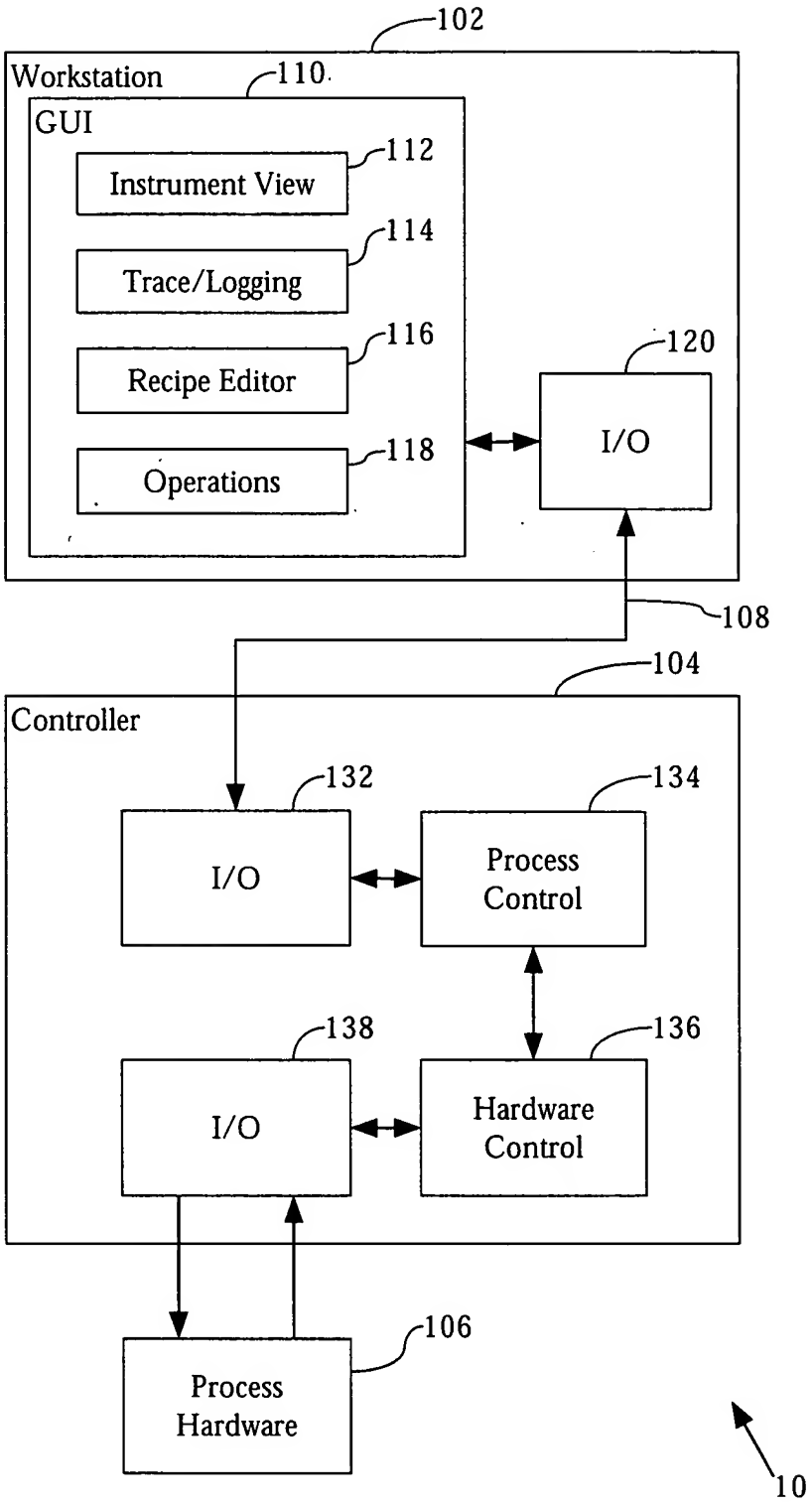
102
Workstation
110
GUI
112
Instrument View
114
Trace/Logging
116
Recipe Editor
118
Operations
120
I/O
108
104
Controller
132
I/O
134
Process Control
138
I/O
136
Hardware Control
106
Process Hardware
10

Fig. 1

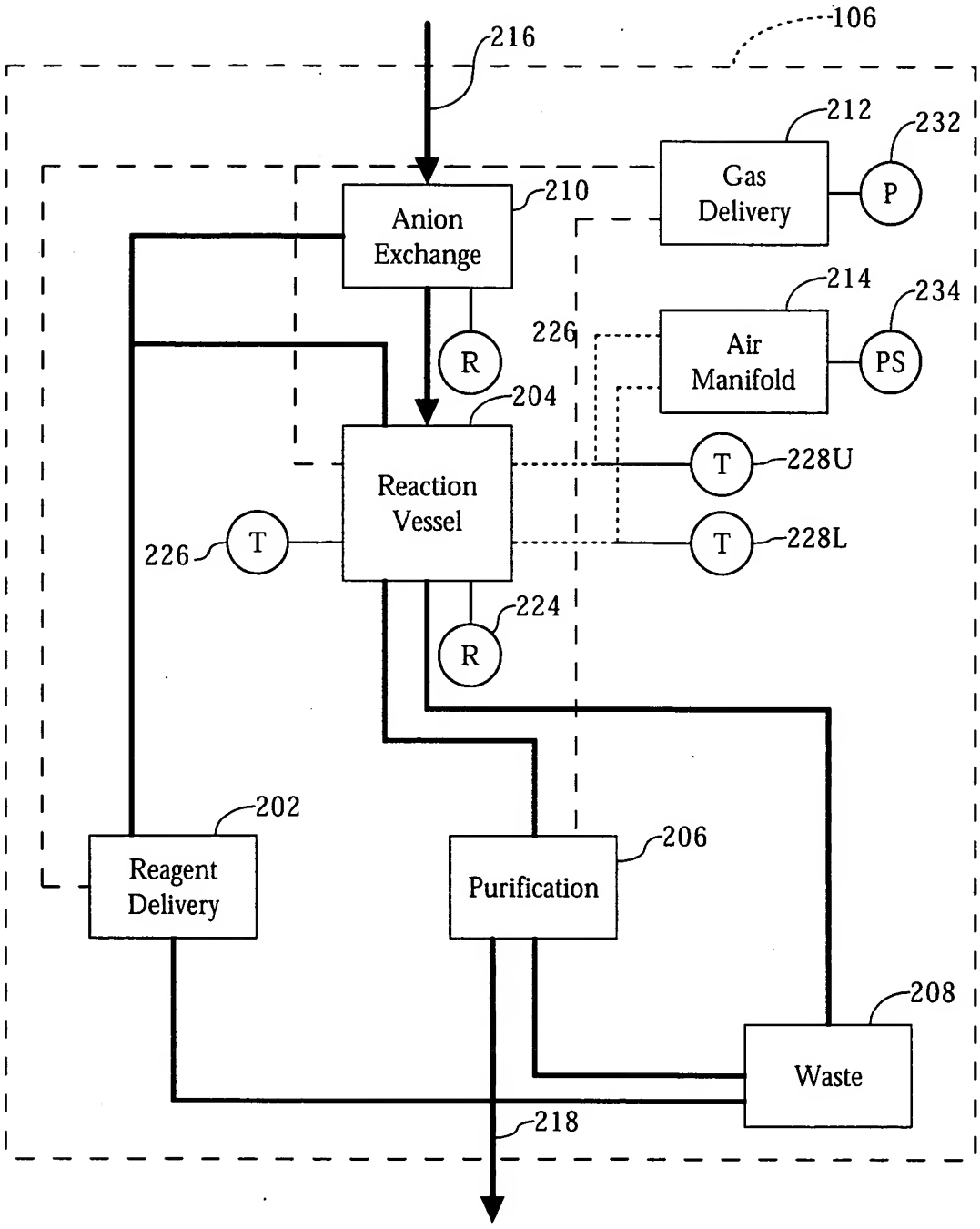
106
216
212
232
Gas Delivery
P
210
Anion Exchange
214
234
226
Air Manifold
PS
R
204
Reaction Vessel
T
228U
226
T
T
228L
224
R
202
206
Reagent Delivery
Purification
208
Waste
218

Fig. 2

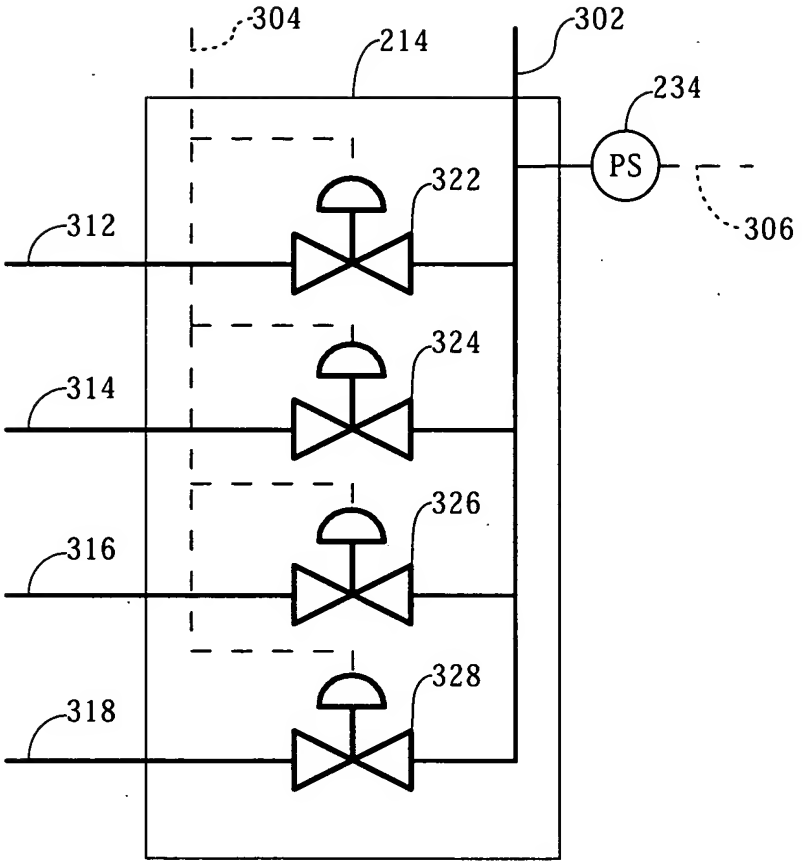

Fig. 3

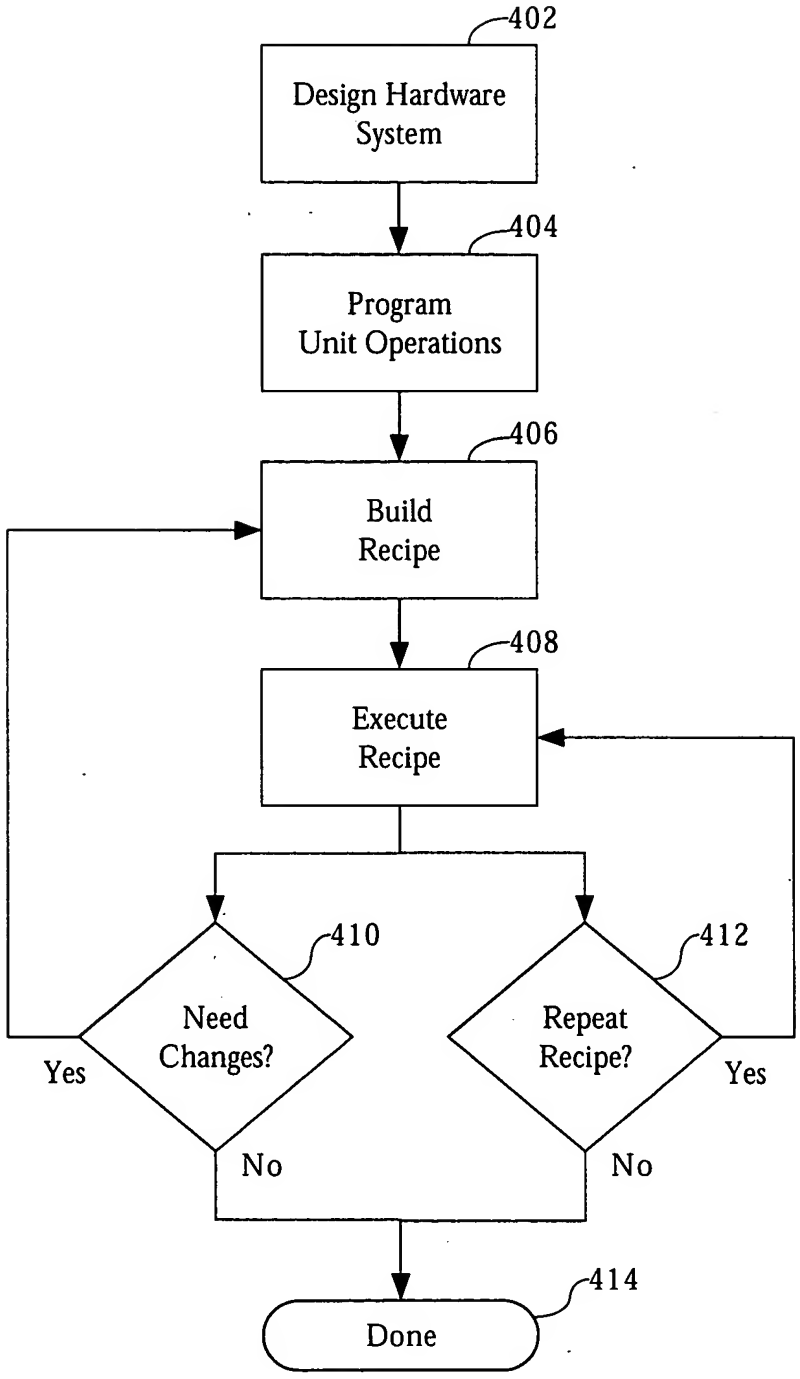
402
Design Hardware System
404
Program Unit Operations
406
Build Recipe
408
Execute Recipe
410
Need Changes?
Yes
No
412
Repeat Recipe?
Yes
No
414
Done

Fig. 4

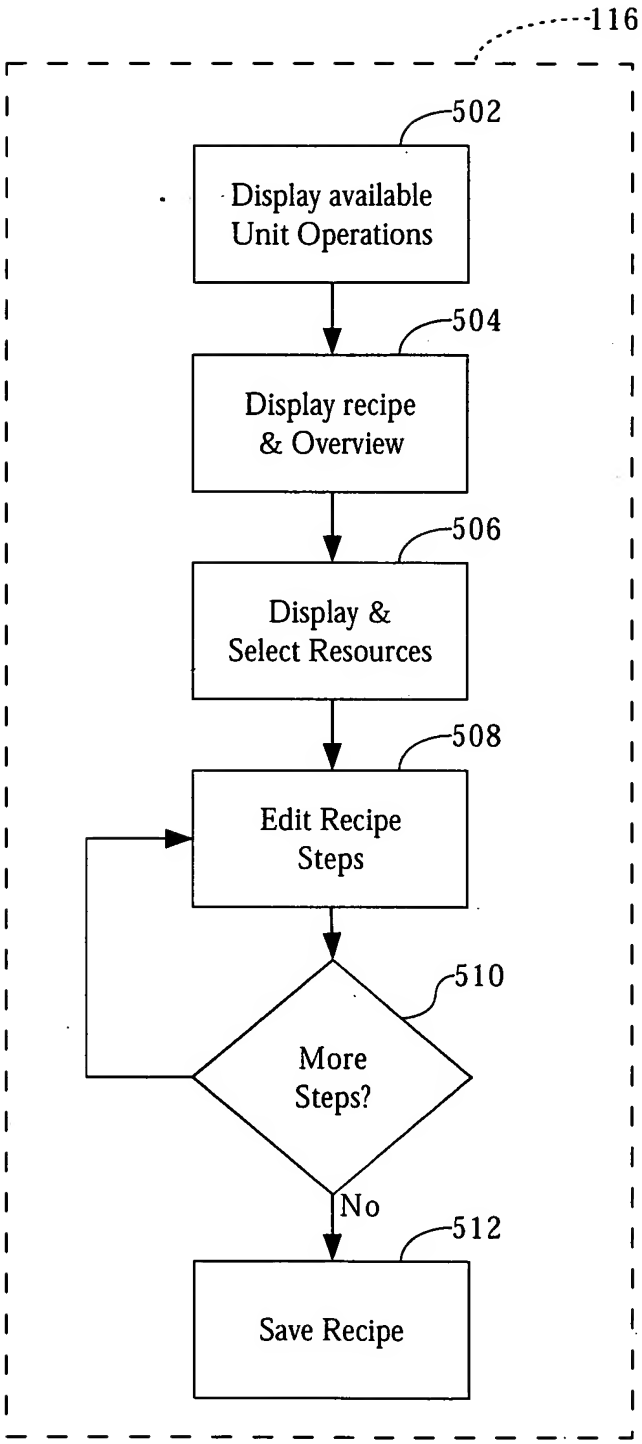
116
502
Display available Unit Operations
504
Display recipe & Overview
506
Display & Select Resources
508
Edit Recipe Steps
510
More Steps?
No
512
Save Recipe

Fig. 5

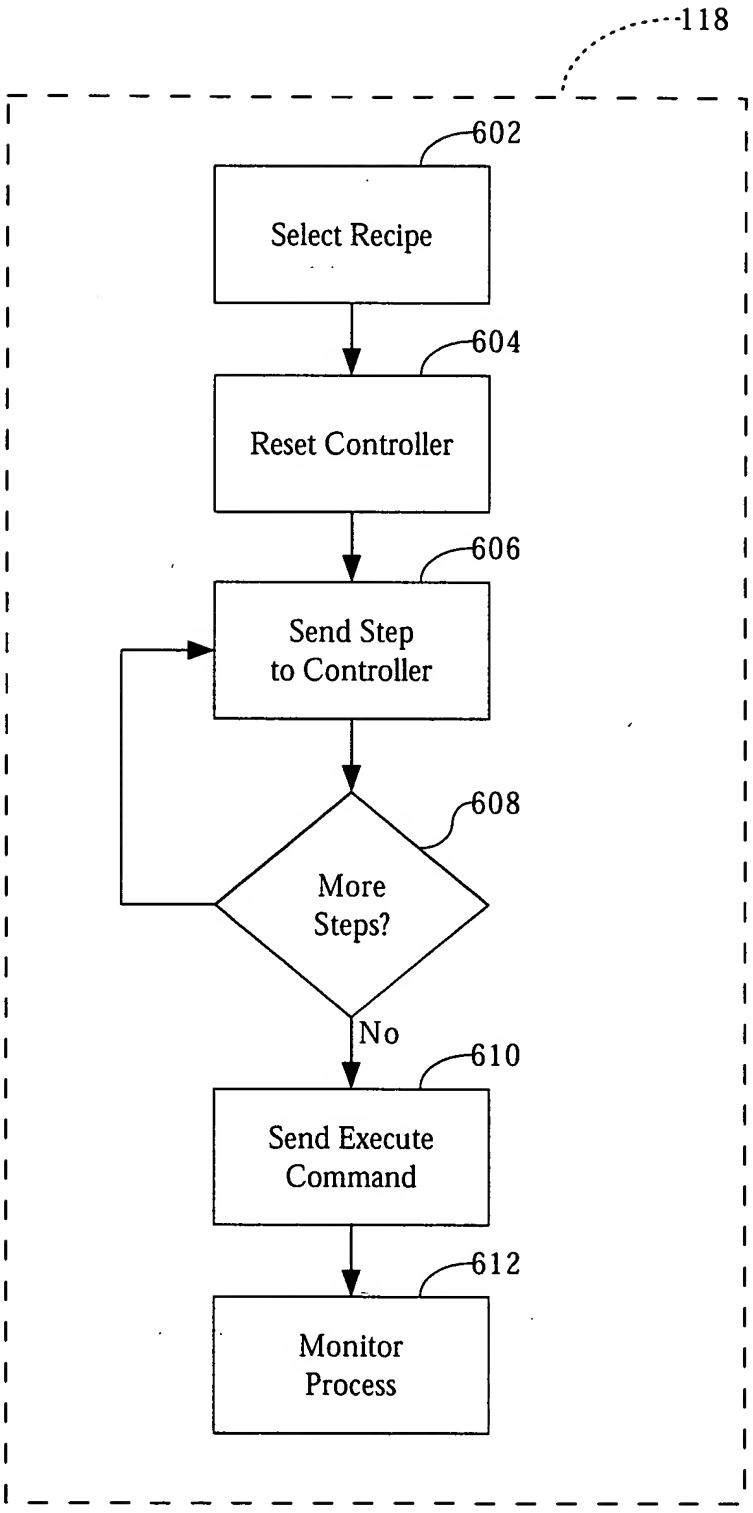
118
602
Select Recipe
604
Reset Controller
606
Send Step to Controller
608
More Steps?
No
610
Send Execute Command
612
Monitor Process

Fig. 6

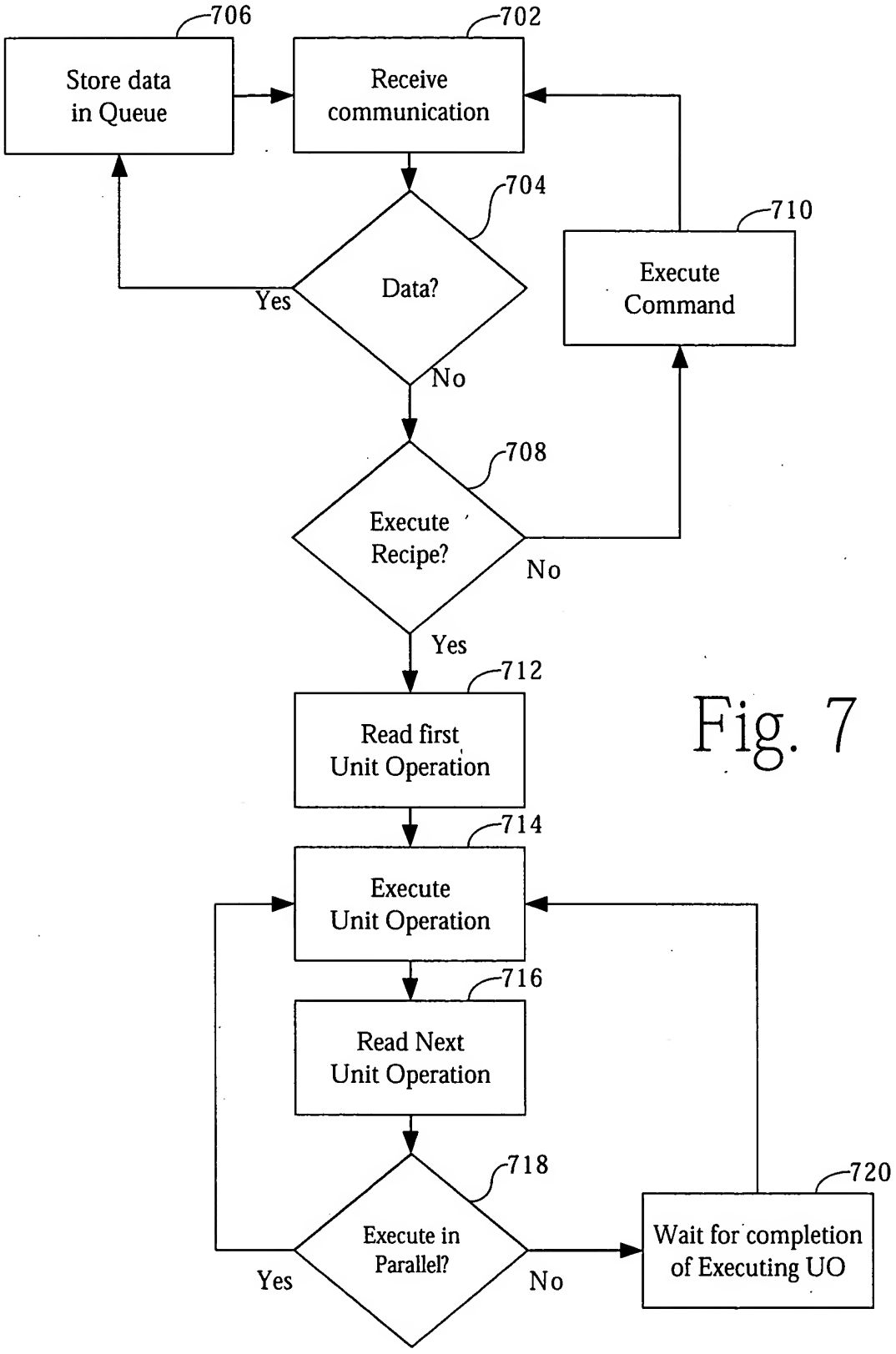
706
Store data in Queue
702
Receive communication
704
Data?
Yes
No
710
Execute Command
708
Execute Recipe?
No
Yes
712
Read first Unit Operation
714
Execute Unit Operation
716
Read Next Unit Operation
718
Execute in Parallel?
Yes
No
720
Wait for completion of Executing UO

Fig. 7

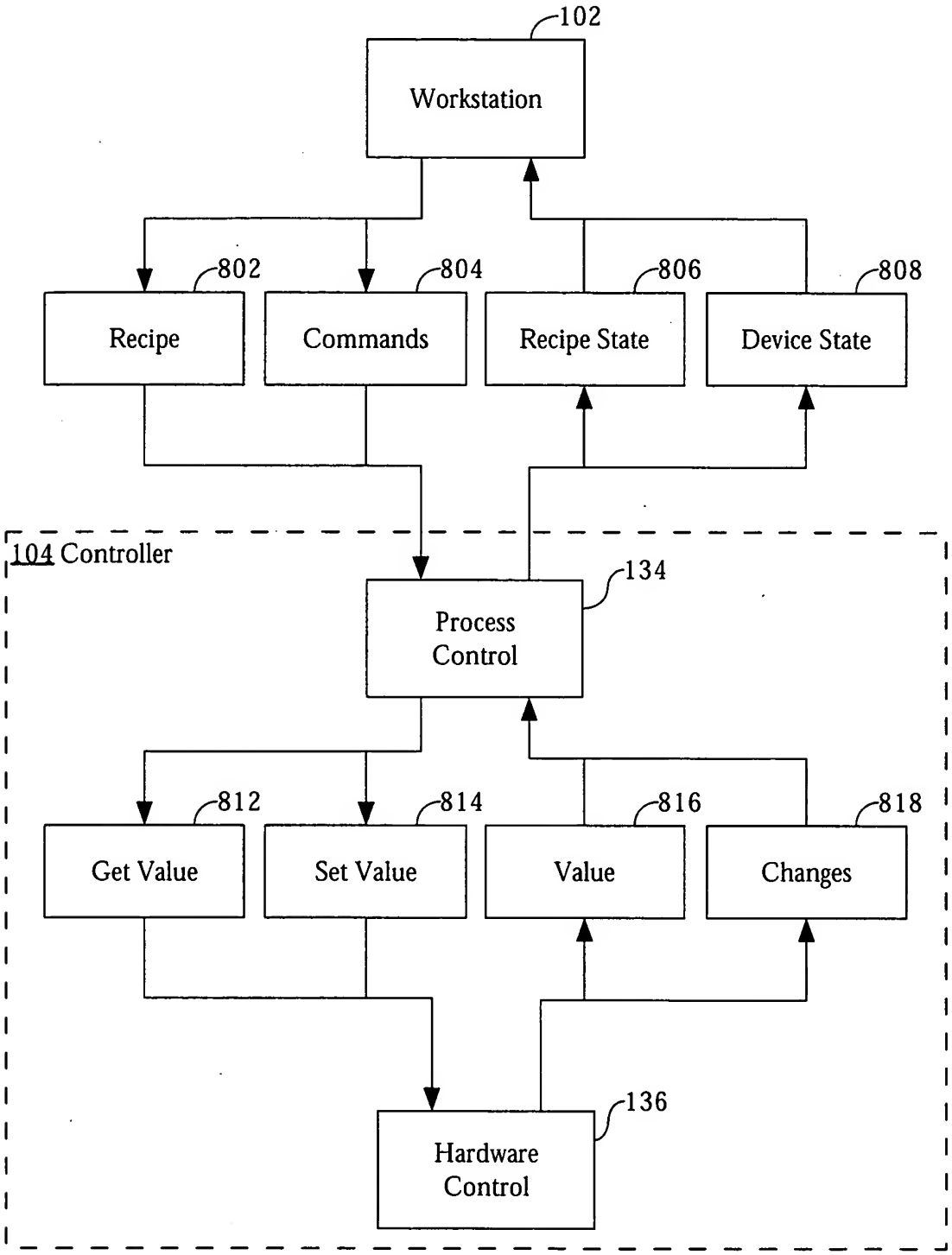
102
Workstation
802
804
806
808
Recipe
Commands
Recipe State
Device State
104 Controller
134
Process Control
812
814
816
818
Get Value
Set Value
Value
Changes
136
Hardware Control

Fig. 8

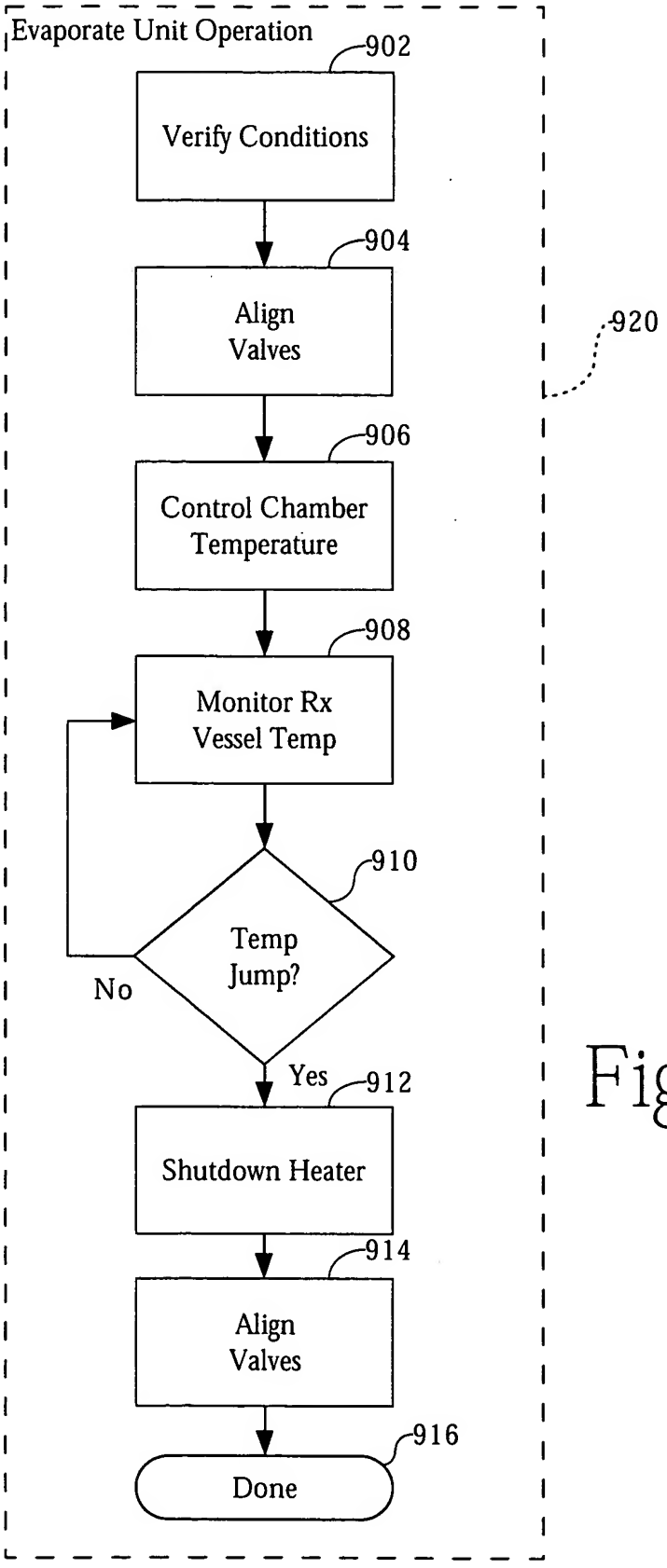
Evaporate Unit Operation
902
Verify Conditions
904
Align Valves
920
906
Control Chamber Temperature
908
Monitor Rx Vessel Temp
910
Temp Jump?
No
Yes
912
Shutdown Heater
914
Align Valves
916
Done

Fig. 9

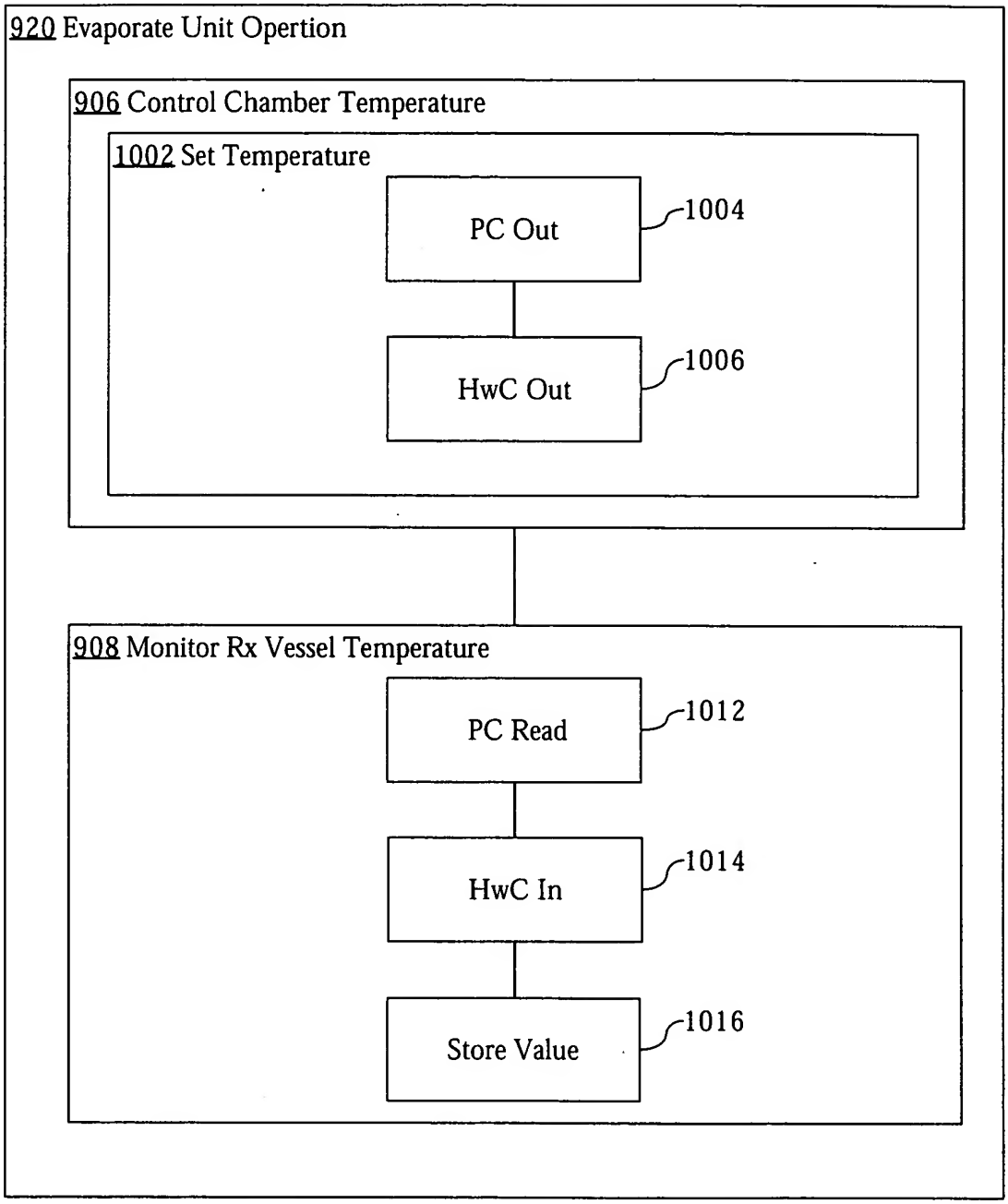
920 Evaporate Unit Opertion
906 Control Chamber Temperature
1002 Set Temperature
PC Out
1004
HwC Out
1006
908 Monitor Rx Vessel Temperature
PC Read
1012
HwC In
1014
Store Value
1016

Fig. 10

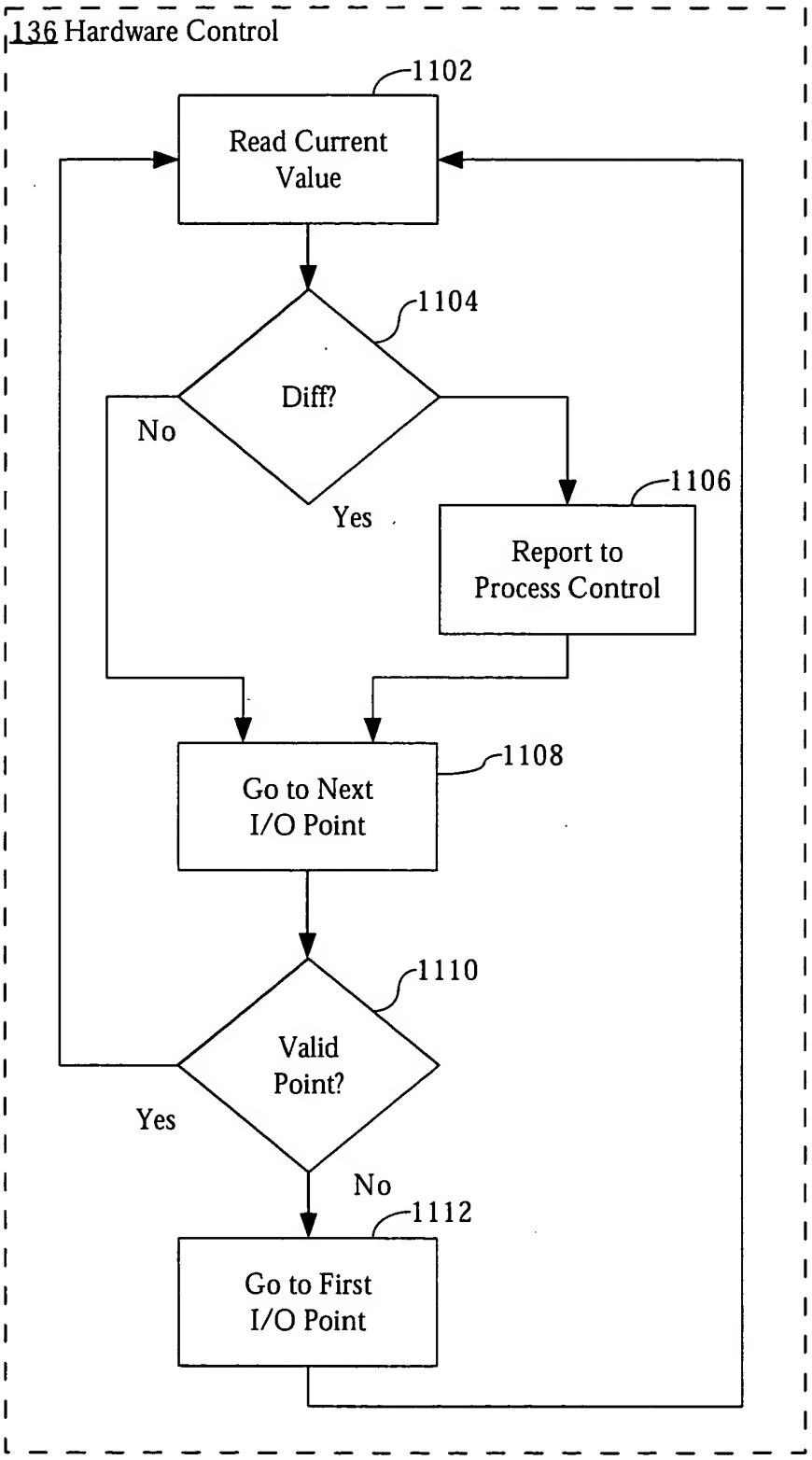
136 Hardware Control
1102
Read Current Value
1104
Diff?
No
Yes
1106
Report to Process Control
1108
Go to Next I/O Point
1110
Valid Point?
Yes
No
1112
Go to First I/O Point

Fig. 11

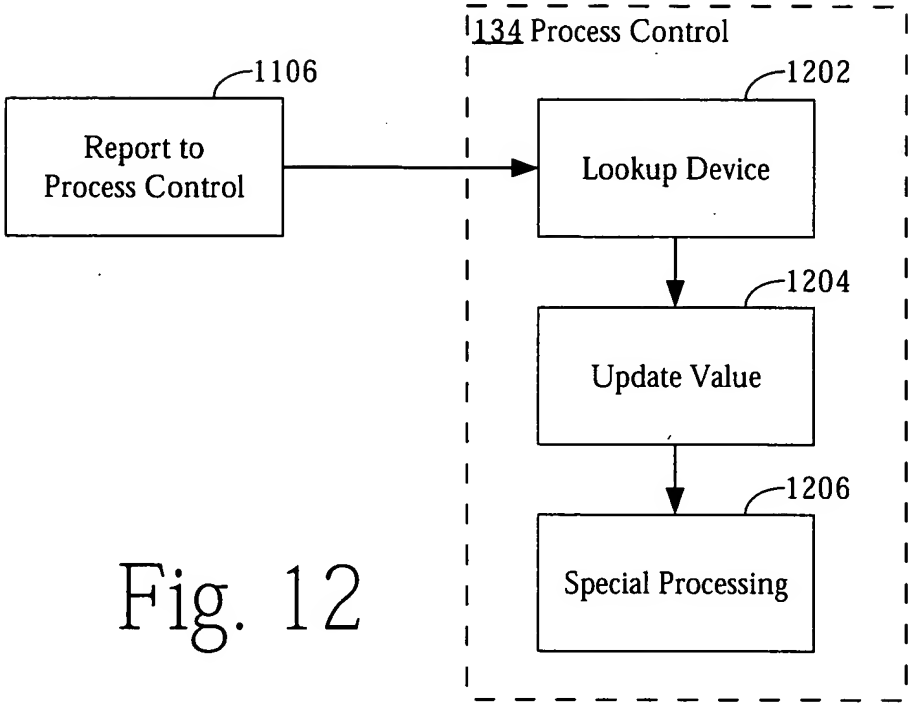
134 Process Control
1106
Report to Process Control
1202
Lookup Device
1204
Update Value
1206
Special Processing

Fig. 12

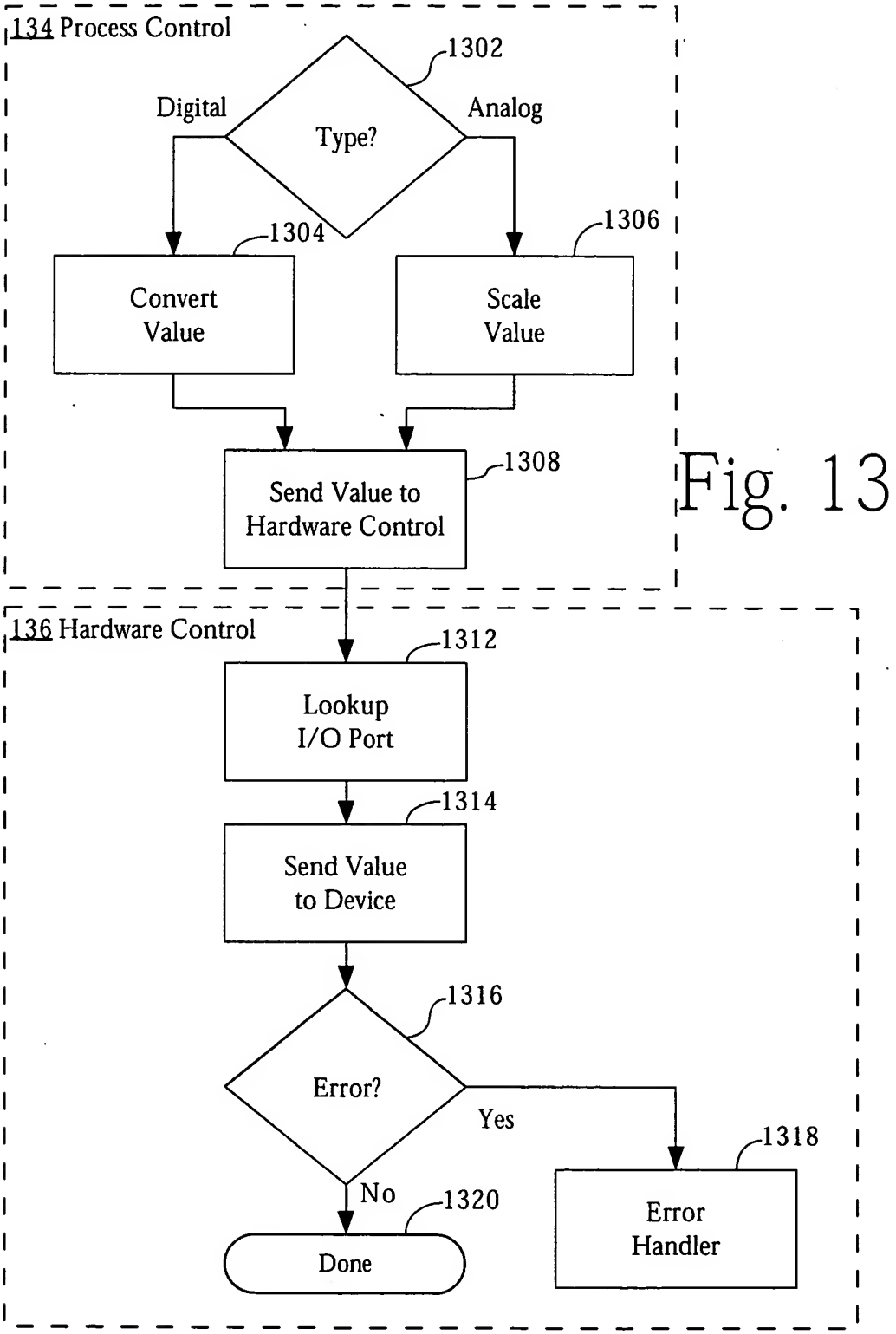
134 Process Control
1302
Type?
Digital
Analog
1304
Convert Value
1306
Scale Value
1308
Send Value to Hardware Control
136 Hardware Control
1312
Lookup I/O Port
1314
Send Value to Device
1316
Error?
Yes
No
1318
Error Handler
1320
Done

Fig. 13

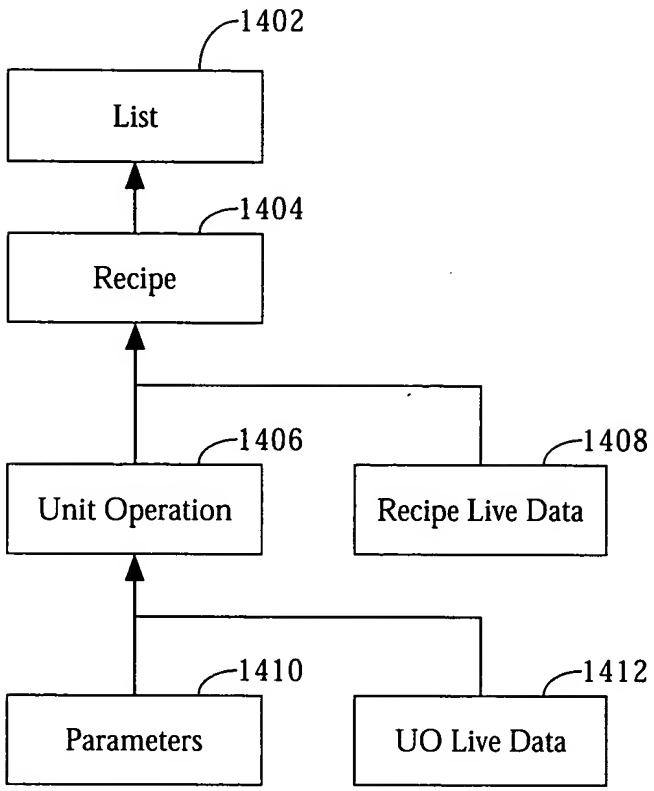
1402
List
1404
Recipe
1406
Unit Operation
1408
Recipe Live Data
1410
Parameters
1412
UO Live Data

Fig. 14

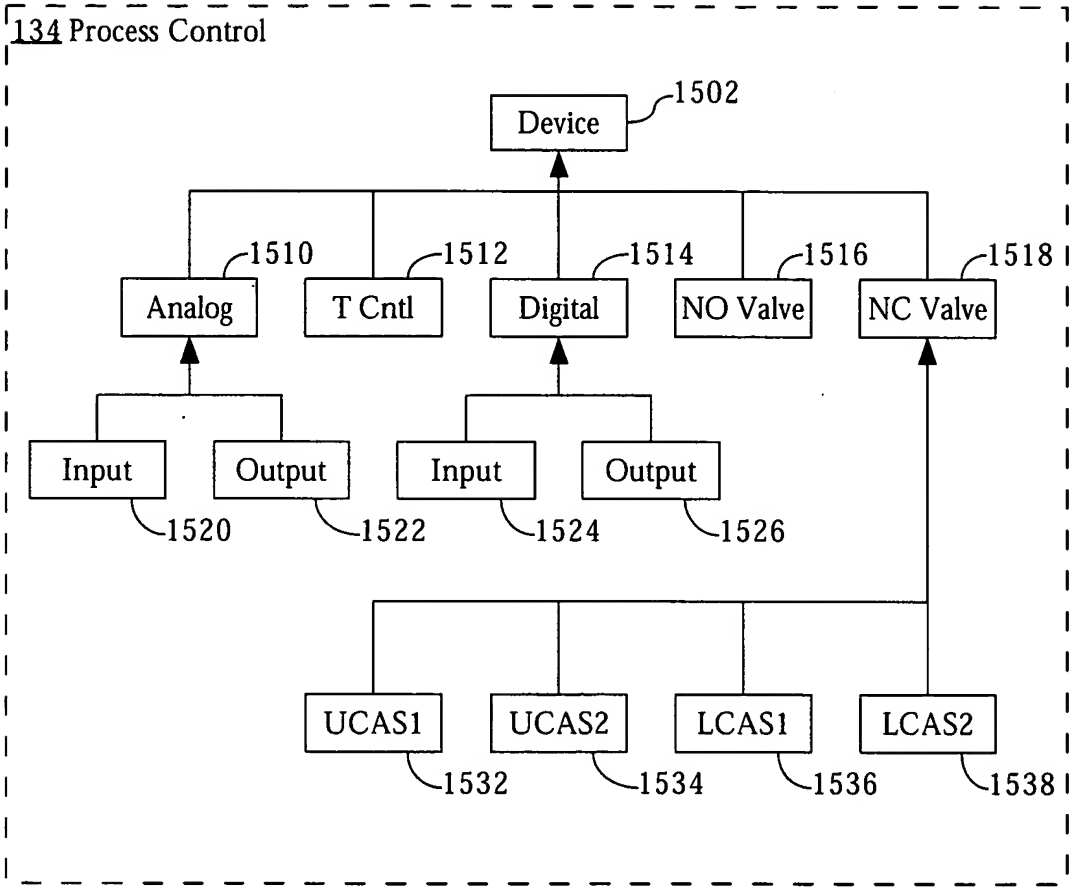
134 Process Control
Device
1502
Analog
1510
T Cntl
1512
Digital
1514
NO Valve
1516
NC Valve
1518
Input
Output
Input
Output
1520
1522
1524
1526
UCAS1
UCAS2
LCAS1
LCAS2
1532
1534
1536
1538

Fig. 15

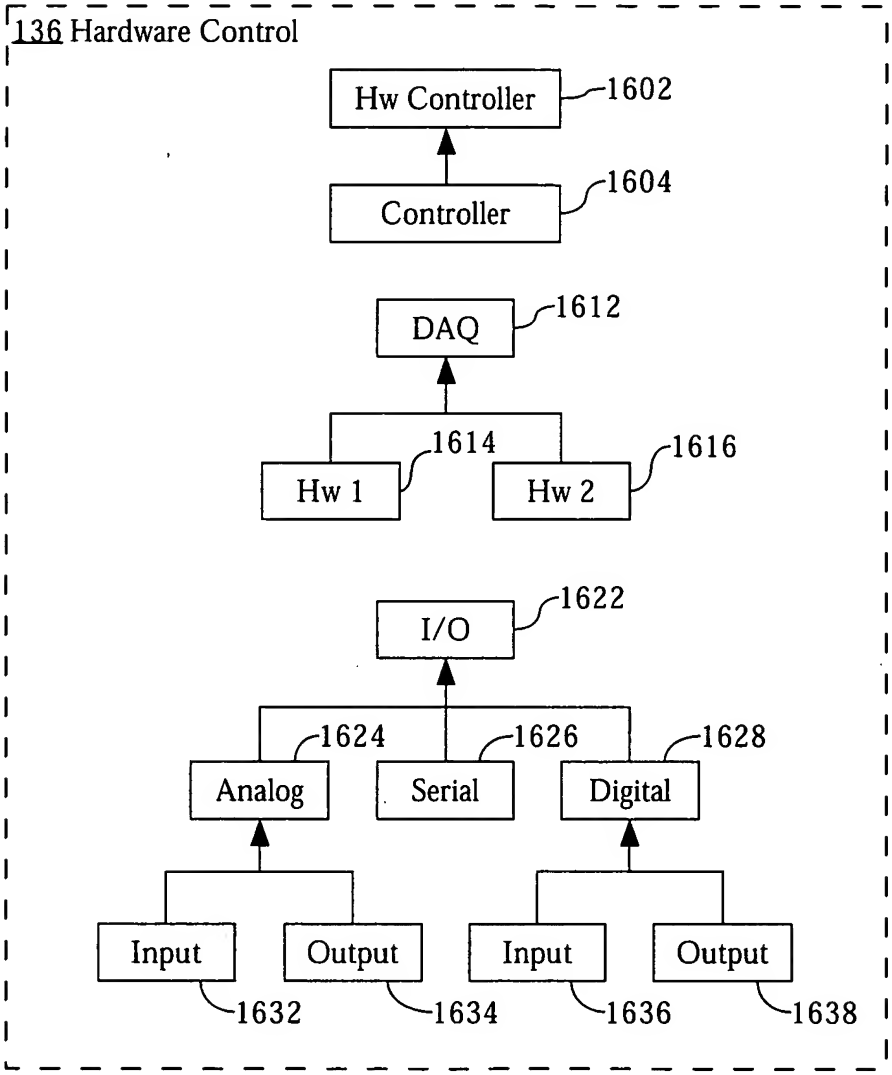
136 Hardware Control
Hw Controller
1602
Controller
1604
DAQ
1612
Hw 1
1614
Hw 2
1616
I/O
1622
Analog
1624
Serial
1626
Digital
1628
Input
Output
Input
Output
1632
1634
1636
1638

Fig. 16